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**BUREAU OF
RAILWAY ECONOMICS**

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**The Cost of Transportation on
the Erie Canal and
by Rail**



Bulletin No. 21

WASHINGTON, D. C.

1911

BULLETINS OF THE BUREAU OF RAILWAY ECONOMICS

1. Summary of Revenues and Expenses of Steam Roads in the United States for July, 1910. (Monthly Report Series, Bulletin No. 1.)
2. Summary of Revenues and Expenses of Steam Roads in the United States for August, 1910. (Monthly Report Series, Bulletin No. 2.)
3. Summary of Revenues and Expenses of Steam Roads in the United States for September, 1910. (Monthly Report Series, Bulletin No. 3.)
4. A Comparative Statement of Physical Valuation and Capitalization.
5. Preliminary Bulletin for November, 1910—Revenues and Expenses.
6. Railway Traffic Statistics.
7. Summary of Revenues and Expenses of Steam Roads in the United States for October, 1910. (Monthly Report Series, Bulletin No. 4.)
8. Summary of Revenues and Expenses of Steam Roads in the United States for November, 1910. (Monthly Report Series, Bulletin No. 5.)
9. Summary of Revenues and Expenses of Steam Roads in the United States for December, 1910. (Monthly Report Series, Bulletin No. 6.)
10. Summary of Revenues and Expenses of Steam Roads in the United States for January, 1911.
11. Comment on the Decision in the Western Advanced Rate Case, No. 3500. (Out of Print.)
12. Summary of Revenues and Expenses of Steam Roads in the United States for February, 1911.
13. Summary of Revenues and Expenses of Steam Roads in the United States for March, 1911.

(Continued on third page of cover.)

The numbering of the monthly bulletins as a separate series was abandoned with the December, 1910, issue. Since then all bulletins issued by the Bureau have been given a consecutive number only.

The Cost of Transportation on
the Erie Canal and
by Rail

WASHINGTON, D. C.
OCTOBER, 1911

THE SOURCES OF INFORMATION utilized in the preparation of this study are the following:

Annual reports of the New York State Superintendent of Public Works.

Annual reports of the New York State Comptroller.

Annual reports of the New York State Engineer.

Report of the Committee on Canals of New York State (Greene Committee), 1899.

Reports of the Inland Waterways Commission, the United States Census Bureau, Bureau of Corporations, and Interstate Commerce Commission.

A. Barton Hepburn—Artificial Waterways and Commercial Development, (New York, 1909).

Publications of the Buffalo Historical Society.

Articles by Secretary John A. Fairlie of the Greene Committee.

Personal interviews with the statistician to the New York State Superintendent of Public Works, assistants in the offices of the New York State Comptroller and State Engineer, and others.

SUMMARY.

A comparison of the cost of transportation by canal and by rail should include not only the immediate cost of conveyance, but also the cost of capital, of operation, and of maintenance.

Since 1882 the canals of the state of New York have been maintained and operated at the expense of the state for the free passage of boats, the only charges paid by the shipper by canal being those of the boatmen for conveyance. This does not mean that the fixed charges and cost of maintenance are obliterated but that they are borne by the community as a whole instead of by the shipper.

Official data indicates that up to 1905 the cost of the Erie Canal was about \$57,600,000 or \$163,600 per mile.

If only four per cent be allowed for interest charges and extraordinary repairs and depreciation on the Erie Canal, and its total cost be taken at only \$55,000,000, the annual fixed charge for these purposes is \$2,200,000. This may be termed the aggregate cost of capital reduced to an annual basis.

As nearly as can be computed from ascertainable data the expense of maintaining the Erie Canal borne by the state of New York for the year 1909 was \$672,105.

As nearly as can be computed from ascertainable data the average ton-mile charge made by the boatmen for conveyance of traffic over the Erie Canal is 2 mills.

A liberal estimate of the traffic on the Erie Canal for the year 1909 is 435,000,000 ton miles.

Apportionment of the aggregate annual cost of capital to this ton mileage gives 5.06 mills per ton mile. The cost of maintenance likewise apportioned gives 1.55 mills per ton mile. These items added to the immediate charge for conveyance of 2 mills make the total cost of transportation of freight on the Erie Canal 8.61 mills per ton mile.

For the same year of 1909 the average freight receipts were 6.2 mills per ton mile by the New York Central, 6.1 mills by the Erie, 7.4 mills by the Lackawanna, and 6.4 mills by the Lehigh Valley.

Whichever one of these various railway average receipts per ton

mile be taken, the cost of transportation on the Erie Canal exceeds it by from sixteen to more than forty per cent.

These average rail receipts moreover include returns from high-grade merchandise such as is not carried in any quantity on the Erie Canal. The traffic of the Erie Canal is composed principally of grain, lumber, iron and iron ore, stone, and coal. The receipts of the railways from such traffic are lower than their average receipts, and therefore the ratio of rail receipts to canal receipts on the kind of traffic that is carried by canal is lower than the above percentages indicate.

The railways moreover are in service all of the time while the canal is idle an average of four and one-half months of each year.

It is impossible at this time to compute or even estimate what the total cost of transportation will be on the new barge canal into which the Erie Canal is being transformed. The Greene Committee of 1899 estimated the cost of the barge canal at about \$60,000,000. Already more than \$100,000,000 have been appropriated for the purpose, and it seems probable that another \$19,000,000 will be required for terminals.

The Cost of Transportation on the Erie Canal and by Rail.

In the wide discussion regarding canals and inland waterways in this country during the past few years, little attention has been directed to the total cost of canal transportation. The term "total cost" is here used to cover not only the immediate cost of conveying goods, but also the cost of maintenance of the canal, cost of ordinary repairs, and fixed charges, dividends, and depreciation charges, if any.

Freight rates via the Erie Canal are frequently contrasted with freight rates via railway, but as they comprise only the immediate transportation cost, that is, the direct charge for conveyance alone, they are hardly comparable with railway rates, which provide the revenue from which must be met not only the cost of conveyance, but also fixed charges upon the capital invested in the plant and the expense of maintenance of plant and equipment. All tolls on New York State canals were abolished in 1882, and the canals since that date have been maintained and operated at the expense of the state for the free passage of boats. Thus the only charges made against a shipper of goods by canal are those of the boatman who handles the goods, and these charges do not help to pay for the maintenance of the canal or for repairs. From the shipper's point of view a canal rate of two mills a ton mile is unquestionably preferable to a railway rate of six mills, if speed and convenience of handling are not as important to him as a low rate. It will be shown, however, that from the broader point of view of the community the railway rate, although apparently higher, may not actually be so. The maintenance and fixed charges on the canal, which are borne by the community, may amount to more than the difference of four mills per ton mile, which is the immediate saving to the shipper. This raises the question whether the burdening of the entire community for the benefit of the shippers, who constitute only a portion of it, is justified. But leaving this question aside, a fair comparison of the cost of transportation by canal and by rail should certainly be of aggregates that include every element in those respective costs.

This study is an effort to estimate the total cost of transporting a ton of freight one mile on the Erie Canal at the present time, and to compare that cost with typical or average railway ton-mile freight

receipts. To reach an estimate of transportation cost on the Erie Canal, it has been necessary to ascertain three items in that cost: first, fixed charges on the canal, or cost of capital; second, cost of maintenance; third, immediate cost of transportation. The sum of these three items will give, fourth, the total cost of transportation.

The Erie Canal is a product of state enterprise, paid for from funds obtained for the most part through loans made by the State of New York. These loans have to a large extent been repaid, partly out of the revenue from the canal, and partly from sinking funds established and built up through taxation. Because of this liquidation of the canal debt, interest charges paid by the state on behalf of the canal have till recently been comparatively small. The canal represents, however, the investment of the people of the State of New York in a transportation plant, just as a railway represents an investment on the part of its stockholders and bondholders. In ascertaining canal transportation costs that shall be strictly comparable with railway transportation costs, it will therefore be necessary to arrive by some method at the physical value of the Erie Canal today and on that value compute fixed charges, representing interest on the investment and depreciation.

But how estimate the value of the canal? There are two ways: first, to take the total cost of construction and permanent improvements to date or, second, to make a physical valuation of the whole canal property. Clearly, it is impossible to value the property without a careful appraisal. The statement so frequently made during the New York State canal campaign of 1903 that the Erie Canal, as it stood, was worth more than the total amount expended on it since its inception, cannot be accepted without proof, especially as value depends so definitely on performance. The canal is not of value except as a canal, and as a canal is valuable only in proportion to the service rendered by it. It is feasible, however, to ascertain the total cost of construction and improvement of the Erie Canal as a measure of its present value.

Complete official data showing the cost of the Erie Canal to 1905, the year when work on the new barge canal was commenced, are not available. The canal auditor of the State of New York, in his annual report for 1882, stated the total cost to that year as \$49,592,000. From 1882 to 1905 a number of special appropriations were made by the New York legislature for the purpose of improving the state

canals, chiefly by deepening the channels and lengthening the locks. Among these appropriations was one of \$9,000,000, made in 1895 for the purpose of increasing the lock capacity and depth of the Erie, Champlain and Oswego canals. Of the amounts spent under the latter appropriation up to July 15, 1898, more than five-sixths, or \$6,787,000, was expended on the Erie Canal.* What proportion of the other appropriations was applied to the Erie Canal it is not possible to ascertain, but the share of that canal in the total was considerably over one-half. The Greene Committee estimated that the cost of constructing and improving the Erie Canal down to 1896 had amounted to \$56,165,000.† It is probable, therefore, that Hepburn's estimate of \$57,600,000‡ as the total cost to 1905 is well under the truth. On the basis of \$57,600,000, the cost of the Erie Canal up to 1905 was \$163,600 a mile, which may be compared with the cost of road per mile of the four main trunk lines between Buffalo and New York—New York Central, Erie, Lackawanna, and Lehigh Valley. The cost of road per mile of these railways, according to the reports made to the Interstate Commerce Commission for 1905, was as follows:

New York Central.....	\$181,250
Erie	292,970
Lackawanna	90,240
Lehigh Valley.....	60,490
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Average.....	\$212,716

Canal construction is far more expensive than is ordinarily appreciated, as is seen from the foregoing comparison.

It will now be possible to estimate the total cost of transportation on the Erie Canal, made up of the three items already enumerated: cost of capital, cost of maintenance, and immediate cost of transportation.

First. *Cost of Capital:* Taking four per cent as the rate of upkeep on the Erie Canal—an item intended to provide for interest charges and for extraordinary repairs and depreciation—and using a con-

* Report of Committee on Canals of New York State, 1899, p. 162. This committee is commonly known as the Greene Committee.

†Report, p. 153.

‡A. Barton Hepburn: *Artificial Waterways and Commercial Development*, p. 100.

servative estimated value of but \$55,000,000 for the canal at the present time, instead of the \$57,600,000 cited above, we have a total annual fixed charge of \$2,200,000. This amount will be apportioned per ton mile of canal traffic in 1909 in a later paragraph.

Second. *Cost of Maintenance*: The cost to the state of New York of maintaining the Erie Canal in 1909, according to data contained in the annual report of the Superintendent of Public Works of that state,* amounted to \$672,105. This amount is ascertained by adding to the \$500,551 of operating expenditures and ordinary repairs a proportion, obtained by pro-rating on the basis of comparative expense, of the total general and division expenses of the canals of the state. This added charge covers administrative and supervisory expenses. The reduction of this item of maintenance to a ton-mile basis will be made shortly.

Third. *Immediate Cost of Transportation*: This is composed of the boatmen's charges for conveyance. Canal boat rates vary considerably with the season, the condition of traffic, and the attitude of the boatmen. There are so few owners of boats on the Erie Canal at present that they can regulate boat rates practically at will. The actual cost incurred by the boatmen in conveying wheat on the Erie Canal was estimated by the Greene Committee of 1899† at 1.75 mills per ton mile. This estimate covers interest at five per cent on investment in boats, all expenses for wages of boathands, and repairs, deterioration, and insurance on boats, without allowance, however, for profit to the boatmen. The average rate on wheat from Buffalo to New York during the season of 1909 varied from 2.07 mills per ton mile‡ in July to 3.33 mills in October and November; and on corn from 1.87 mills to 3.07 mills. The average for the season was 2.60 mills per ton mile on wheat and 2.35 mills on corn. These rates differ by less than one-half of one per cent from the average of the rates reported by the Superintendent of Public Works for the years 1900 to 1909, and may therefore be considered as representative. The foregoing rates and estimates apply to grain only. For all commodities moved on the canals of New York State, the average ton-mile rate between 1903 and 1907 was 2.00 mills.§ An

*Report for 1909, pp. 31-39.

†Report of Committee on Canals of New York State, 1899, p. 57.

‡Ascertained by reducing the through rate per bushel to a ton-mile basis.

§Hepburn, p. 104.

estimate of 2.00 mills for the average ton-mile rate on the Erie Canal today would therefore seem to be a reasonable one. This represents the immediate charge for conveyance.

Fourth. *Total Cost of Transportation:* Of the three components of transportation cost so far discussed, two have been gross amounts for the Erie Canal as a whole, while only the last is expressed in terms of ton-mile traffic. To reach a figure of total cost per ton per mile it will be necessary to ascertain the total ton mileage of the traffic on the Erie Canal in 1909, and reduce the first two amounts to a ton-mile basis.

Unfortunately, no ton-mileage figures are reported for the canal traffic in New York State at the present time. It will be necessary to make an estimate for the Erie Canal based upon the reports of tonnage carried. The total number of tons of freight carried on the Erie Canal in 1909 was 2,031,307. What proportion of this was through freight was not reported, but if the proportion was the same as in 1908, then 436,731 tons consisted of through freight, and 1,594,576 tons of way freight. If we assume that way freight was carried an average of half the length of the canal, or 176 miles—which is a liberal assumption—and that all the through freight was carried the whole length of the canal, or 352 miles, we have a total ton mileage of 435,000,000 for 1909.

On the basis of 435,000,000 ton miles of traffic in 1909, the fixed charges or cost of capital, \$2,200,000, were equivalent to 5.06 mills per ton mile; and the cost of maintenance, \$672,105, to 1.55 mills per ton mile. The total cost of transporting one ton of freight one mile on the Erie Canal in 1909 was made up, then, of the following items:

Cost of capital.....	5.06	mills
Cost of maintenance.....	1.55	"
Immediate cost of transportation.....	2.00	"
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Total	8.61	mills

Thus there is obtained a total charge for canal transportation of 8.61 mills per ton mile, directly comparable with a railway freight rate. What railway freight rate or receipt shall be quoted in comparison with this 8.61 mills of canal cost? By the four principal railways running between Buffalo and New York freight receipts

per ton mile in 1909 were reported to the New York State Public Service Commission as follows:

New York Central.....	6.2	mills
Erie	6.1	"
Lackawanna	7.4	"
Lehigh Valley.....	6.4	"

Whichever one of these various railway average receipts per ton mile be taken, the cost of transportation on the Erie Canal will be found to exceed it by from sixteen to more than forty per cent. Even when compared with average railway receipts for the whole United States, the Erie Canal cost of transportation is considerably the higher. Thus average freight receipts per ton mile in 1909, for all the railways of the United States, amounted to 7.63 mills, as compared with 8.61 mills of cost on the Erie Canal. For specific commodities the result is similar. The Interstate Commerce Commission reports that average railway freight receipts in 1909, for four of the commodities which make up a large part of the Erie Canal traffic, were as follows:

Grain	6.11	mills
Lumber	7.70	"
Anthracite coal.....	6.03	"
Bituminous coal.....	5.12	"

None of these averages, it will be observed, is as high as the average cost of transportation via the Erie Canal.

All this is true despite the very conservative estimates in making up the figures for the Erie Canal—and this conservatism is worthy of special emphasis. Thus the ton mileage estimate used is probably too large, and the ton-mile canal rates based on that estimate are correspondingly low. In the opinion of the statistician to the New York Superintendent of Public Works, the average length of haul of way freight over the Erie Canal is not over 100 miles, yet the estimate here adopted is 176 miles. Again, four percent is a conservative rate for depreciation and interest. The stock and bonds of all the railways in the United States in 1909 had an average dividend and interest rate alone that exceeded four per cent, and an allowance of four percent for both interest and depreciation charges

in connection with the Erie Canal, is, in comparison, clearly a minimum. Finally, the estimate of value of the Erie Canal property used in the computation is considerably lower than the estimates of the Greene Committee and of other careful students of canal history.

Another fact that must be recognized in a comparison of railway and canal transportation costs is that the grade of goods shipped via canal is far inferior to that shipped via railway. The goods sent by canal are bulkier, coarser, of less value, and naturally are carried at a lower average rate. Of the tonnage carried over the New York canals in 1909, for example, nearly a third (31.8%) consisted of stone, rock, lime and clay; another third (36.6%) consisted of coal, iron ore, pig iron, boards, timber, pulp wood and wood pulp; while a fifth (21.2%) was made up of grain, ice and salt. It is clear that an average railway freight rate based only on such articles as were carried by the Erie Canal in 1909 would be lower than the average freight rate on all articles carried by railways. The computations made above, therefore, result in an average canal rate lower than if the grade of articles carried by the canal averaged as high as on the railways. Notwithstanding this, the average canal rate, as has been shown, is actually higher than the highest average railway freight receipt quoted.

One cause of the high cost of transportation on the Erie Canal is the fact that the canal remains idle so large a part of each year. The average length of the canal season is 223 days, or about $7\frac{1}{2}$ months. During the remainder of the year the plant and the boats lie practically idle, although all of the general and many of the maintenance expenses continue without change. In the estimate of the Greene Committee regarding the actual cost of transportation, allowance was made for this period of idleness by computing all expenses on the basis of only seven round trips a year—a full load on the down trip and a third of a full load on the return. But in estimating depreciation and interest charges no such allowance can be made—the plant is in existence and must be maintained, whether in operation or not. Whether or not this long period of idleness each year on the part of the canal is responsible for a large or a small part of the greater cost of canal as compared with railway transportation, it is an inherent feature of canal business in the state of New York and must be taken into account when comparing the canals and railways of that state.

This study has been limited to the Erie Canal of today, all the statistics being based on past performances of record. The people of the state of New York are now engaged in spending more than \$100,000,000 in the enlargement and improvement of the canal system of their state. What the total cost of transportation on the new barge canal now emerging from the old Erie will be, no one is in a position to know definitely. The Greene Committee of 1899 estimated the cost of the barge canal at about \$60,000,000. Already more than \$100,000,000 has been voted for this purpose, with the possibility that another \$19,000,000 will be required for terminals. The Greene Committee also made an estimate of the cost to the boatmen of conveying goods through the barge canal, corresponding to their estimate of 1.75 mills on the old Erie referred to in an earlier paragraph. The estimate on the barge canal was 0.52 mill. Whether this estimate will prove to be approximately accurate, or whether time will show it to have been too low, no one at the present time can tell, as no facts exist on which even an approximation may rest. It is clear, however, that having added so greatly to the cost of the canal, rates must be much lower, or volume of traffic far greater, or cost of maintenance and repair lower in proportion to volume of traffic—one or all of these must result before the total cost of transportation on the new Erie will fall to or below the level of the average railway freight rate.

It seems clear, then, from the data presented in the foregoing pages, that the transportation of goods on the Erie Canal at the present time is a more expensive process, considered from the broadest point of view, than on the typical or average American railway, whether or not that railway be one that competes directly with the canal.



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